

RELEASE 1.0

6-94

ESTHER DYSON'S MONTHLY REPORT

27 JUNE 1994

MULTI-USER VIRTUAL ENVIRONMENTS, PART I

by Jerry Michalski

Text-based multi-user games on the Internet are popular -- despite their interfaces. These so-called MUDs and MOOs (Multi-User Dungeons and MUDs that are Object-Oriented, respectively; see Release 1.0, 6-93) are a throw-back to time-sharing days and use a command-line interface. Almost no MUDs or MOOs use graphics. Places, people, objects and events are described in prose, which is often eloquent. Commands are often arcane. To make one character wave at another, a MOOer might type "@emote waves at phantom." The system would show other participants in the same virtual room the message "spiff waves at phantom."

Of course, the text-only interface can liberate as well as constrain. Text can describe actions, relationships and scenes that would be difficult or impossible to render or model visibly. (Movies never do live up to good books.) Participants can evoke emotions the same way that a good book does. Also, many MOOs allow people to create novel objects with specific behaviors; the text interface allows those objects to be impossible or highly improbable.

Virtual reality games are gaining popularity, too. In 1989, VPL Research fielded one of the early virtual reality setups that the public could use (see Release 1.0, 10-90). It had an electronically turbocharged helmet and glove that one person puts on at a time. To move, a user points a finger in the desired direction; to pick an object up, she gets the glove near the desired object (both displayed on small screens in front of her eyes) and uses a grasping motion.

Now there are VR games for small groups of players, such as Virtuality Entertainment's Dactyl Nightmare. In that game, players don special gear and stand on LAN-connected motion-sensing platforms. Then, in time-honored game tradition, they try to shoot each other while they hide behind objects, evade other attackers and dodge the occasional flying reptile.

Great, good places to work

Playful as all this may sound, there are compelling, mainstream business uses for these tools, beyond the obvious applications of VR such as architectural walkthroughs and multimedia kiosks -- or the navigational interfaces of our 500-channel future. Think of

→
THE TRANSCRIPTS ARE ALMOST DONE!

<u>INSIDE</u>	
VIRTUAL WORLDS	1
Build a Metaverse.	
MULTI-USER ENGINES	8
Kesmai's Aries platform.	
Virtual Universe.	
THE CLIENT SIDE	12
Virtual Games.	
Apple's QuickTime VR.	
Knowledge Adventure Worlds.	
Immersive Systems' Meme.	
RESOURCES & CALENDAR	19
Names, phones, dates.	

the status quo. Some workers are already drowning in e-mail messages, which lie, unfiltered, unthreaded and unread, in swelling in-boxes. Lotus Notes is *de rigueur* for distributed corporate collaborations. Part of its appeal is the structure that it adds to such interactions.

The emergence of shared virtual worlds could have repercussions far beyond the computer games industry and the scientific and technical communities. Virtual environments are a product to be sold *and* a medium for commerce and commercial organizations' daily lives. They could affect user-interface design, communications (see Release 1.0 on unified messaging, 12-92), information navigation and commerce.

The trend is already under way. Biologists around the world use a MOO called BioMOO (what else?) to collaborate. Similarly, Amy Bruckman's MediaMOO at MIT's Media Lab is a home for researchers actively investigating media and technology. MOOs add important elements to the discourses, starting with a shared context in the form of a persistent environment. Objects such as session transcripts or document drafts stay in the place visit after visit. The place itself becomes familiar.

People can set rooms aside in the MOO for different topics and can furnish and decorate them appropriately. Some participants may create tools or objects (e.g., work aids, idea prototypes, discussion maps) that everyone uses and that help move the discussion forward. People can project their personalities by how they name and describe themselves, and thereby get to know each other. Creating such a space together is a significant community-building exercise. Think of it as the barn-raising of the modern age. The resulting space may hold special meaning for the participants. Of course, it can also be the site of major crises and ill will.

Who will be the Steelcase and Herman Miller of the electronic workplace?

Fight the telecommuting blues!

There are other, pragmatic reasons to use MUDs and MOOs. Kevin Goldsmith, a developer at Colossal Pictures, used to work three floors away from the rest of his colleagues. To mitigate the isolation, he would keep a MUD window open on his screen while he worked. This way he could visit with colleagues and friends whenever he wanted to in the virtual place of their choice. Goldsmith says, "Working with computers is basically very isolating. Shared spaces are good ways of breaking the isolation."

As telecommuting takes hold, MUD-like environments will be an appropriate way to supplement dry work documents and tools with people-friendly objects such as the water cooler down the hall or the lunch room. Of course, there's much that one can do with e-mail or shared document databases. But the MUD interaction is richer, more casual and has more context. Instead of e-mailing a compound document as an attachment or checking it out of a document database, one could pick it up off the table in a virtual workroom. Put it back down, and others could view it.

MUDDing facilitates "legitimate peripheral participation," a term that Xerox PARC's chief scientist John Seely Brown discussed in his speech at PC

Forum last March. Legitimate peripheral participation occurs when the members of a group can hang out at the boundary between the center of a group and its periphery. The members are not responsible for the conversation but are free to join in whenever they wish. To illustrate how communities of practice form through legitimate peripheral participation, Brown described an experiment in which Xerox repair technicians were outfitted with two-way radios that created a shared audio space. They could listen in at the periphery and jump in when they saw fit.

It's easy to find out who is around in a MOO. You get a sense that other people are present, which in turn makes it possible to hang out informally and strike up conversations. It's also easy to imagine how a sense of people's presence might be communicated in a more visual (and auditory) environment, with shadows in the doorway, or walking sounds in the hall. Maybe you can see a friend's distinctively colored sweater on the couch in the lounge area. Maybe his leitmotif plays softly wherever he goes, announcing his presence gently. (If you were reading this newsletter in such a space, *Peter and the Wolf* would now be playing in the background.) If you don't like someone, hang a virtual bell on him that only you can hear.

When MOOs meet VR

There's no reason that MOOs have to be exclusively textual -- or VR games violent. There's no limit to the variety of tools and virtual environments that people could design, or the way they could blend them with their physical lives. This issue of Release 1.0 examines what happens as MOOs and VR intersect with each other, and merge with other technologies. Our perspective is pragmatic and somewhat technical, but we also explore the social implications.

The virtual and the real co-evolve

As MOOs and VR meld and adapt to business, how will each side change? Since the focus in business is usefulness and payback, not entertainment, developers may need to tone down the cartoonish aspects and greatly enhance the task/communication features. There may be other good reasons to tune the appearance of objects and avatars (see verisimilitude, page 12).

There will likely be social effects. Perhaps we will set up meetings or negotiate deals using 3D avatars (software personae). The new tools may help us find new vocabularies or norms. For example, an early groupware product, Action Technologies' Coordinator, forced users to be explicit, which many people didn't like. Virtual environments may offer ways to adjust the level of explicitness in personally and socially acceptable ways.

Flights of fancy

We will also see a blending of artificial life with real life, of reality (photographic stills or video clips) with construction (synthetic environments). Imagine an educational space where you can meet your friends anywhere in history, where images can lead to information or discussions, and where objects are animated and programmable (perhaps kids can use Lego Logo). At the end of the exploration you have a teleconference with another real classroom in France. The other class is real, not virtual, and all of you discuss your experiences and reactions.

Imagine a version of Maxis' SimCity (Release 1.0, 2-92 and 6-89) in which you can inspect the town hall and discover that it is an active simulation involving people playing roles in a MOO. As they evolve policy or decide to test hypotheses, they feed variables and events to the outside system.

Imagine a virtual plaza or cafe where you habitually meet your friends at teatime. Some of those friends really are in high-tech cafes; others are behind their desks, sipping virtual cappuccinos. When they want to, participants can "step" away to a game of virtual squash or to the electronic mall. They can also go to a private conference room and work.

 "You need multiple people to fill a virtual reality;
 otherwise, all you have is a virtual space."
 -- James Durward, Virtual Universe

Out of breath in cyberspace

In case these ideas sound outlandish, consider Heartbeat, a startup that is working to link games to exercise bicycles and inexpensive heart rate monitors -- and then to each other over ordinary phone lines, using hybrid modems that permit simultaneous transmission of voice and data.

The resulting kit, the Heartbeat Personal Trainer, could put some fun back into exercising. You might "fly" the Personal Trainer over a simulated Venusian landscape, with your craft's performance tied to your heart rate. If you slack off, you might just end up in the drink. Or a few new opponents, other people on *their* bikes, might appear on-screen, with competing scores handicapped for each person. Heartbeat has licensed hockey and golf games from Electronic Arts.

The best of all possible worlds

There are many possible worlds to design (see box, page 5). They can be nested and interwoven: the virtual cafe can have doorways to America Online or the Museum of Natural History. But today each environment does things its own way, with the exception of the World Wide Web on the Internet. To make this work, there will have to be some agreements. It's not clear that everyone must describe places or objects the same way. This is a good time for actual and prospective service providers to open discussions on what to agree on to maximize connectivity and preserve diversity, with access to a robust, legitimate and ubiquitous transaction platform.

There are many different ways to represent, store, transmit and render virtual environments on multiple platforms.¹ The choices best suited to design and deliver a static virtual world that one user can browse may not be

¹ Should one machine send another a request to draw a custom software object that's stored locally on CD-ROM (say, some compact code that says, "Draw the teapot object and color it pink")? Should it transmit bitmapped images, video clips or polygons, or should it send customizations to a globally agreed-upon object hierarchy (the reference teapot approach)?

the best choices for a highly distributed, dynamic world in which many players meet and interact, especially if they can all create new spaces or objects at will. To complicate things, some of those objects might be programmed, such as feature-rich telephones, X-ray goggles or magic sneakers that allow users to fly over the virtual terrain. Some objects will be avatars that represent other people online. Some will look like other characters, but be script-driven user agents or droids.

Passion Sources

Many developers have been inspired to create new software environments by the vedas of Cyberspace: William Gibson's *Neuromancer* and Neal Stephenson's *Snow Crash*. Gibson's matrix, the locus of cyberspace in *Neuromancer*, is an impressionist -- almost abstract -- painting. Gibson's hero, Case, "jacks in" to cyberspace using an Ono-Sendai Cyberspace 7 "deck". He works his way through protective "ice" (intrusion countermeasures electronics) to break into other organizations' databanks.

In contrast, Stephenson's *Metaverse* is rich with detail. It is complete with burbclaves (suburban defended enclaves) and franchulates (autonomous territories owned by commercial franchise operators), zoning laws and procedures for buying frontage on the Street (start with the Global Multimedia Protocol Group and be prepared to grease a few palms). People enter and exit the Metaverse at Ports and appear as avatars, which they can customize with the Avatar Construction Set or by hacking some code of their own. Good avatars are status items.

Framing the (virtual) space

A concept space for multi-user virtual environments itself would require at least five dimensions to describe such aspects of each environment as the following:

How does the environment engage the senses? What is the interface technology? Most MUDs and MOOs use plain, unadorned text. Participants generate their own mental images. This allows practically anyone to participate, since practically all computers and many game machines can display text and have keyboards. The Jupiter project, an extension of the LambdaMOO run by Pavel Curtis at Xerox PARC, combines MOO text with multiple-media enhancements such as video windows, audioconferencing and useful shared-work tools. (We will revisit Jupiter in a future issue of Release 1.0.)

More graphical environments can use photographic or generated art, which ranges from 2D (e.g., Habitat, Magic Cap), to pseudo-3D (QuickTime VR, page 13) and varying degrees of full 3D (Kesmai's Air Warrior, page 8, and Knowledge Adventure Worlds' virtual worlds engine, page 15). Finally, highly immersive environments such as Dactyl Nightmare often require participants to don stereoscopic helmets or other gear. Audio can greatly improve the sensory experience of all these environments, from plain text to VR. Localizing it -- balancing it between the left and right channels to give the impression that it's coming from a particular place relative to the user -- is an added boon.

How many people can participate at once? Group size has at least three, and possibly four break points: one person, two to eight people (usually on a LAN or point-to-point with modems), under 100 people and over 100. The difference between one and two players is obvious. Eight people can usually keep track of each other and know what they are all up to.

Beyond roughly eight people, interesting social phenomena can occur, including the formation of teams, economies, interest groups, countries subcultures and political parties. There is differentiation and speciation. So far, the practical limit of shared virtual environments is around 100 concurrent participants. It is possible to imagine a virtual place in which one could view a much larger crowd assembled at once. What its social implications might be are hard to guess and would depend on local rules and norms. In various cases it may range from mob behavior to a deep sense of unity or community.

What is the environment's architecture? This is correlated to, but not the same as, group size. Single-user systems can usually run on one machine, though they may require serious server power. Many small-group systems use peer-to-peer architectures. Most large-group systems use a client/server architecture, where client machines receive information from the server, which is calculating where all the participants are and what they can each see and do.

It is possible to have highly distributed virtual environments with no central control or data. The easiest example is a virtual world where most of the participants create rooms that exist on their host machines, very much the way the World Wide Web holds people's home pages (see Release 1.0, 1-94). A subgroup of Web volunteers is now at work on VRML, the Virtual Reality Markup Language, which would make such a system possible.²

A related issue is where objects or object libraries are located. Typically, system developers distribute object libraries beforehand (in some cases users download them from the service providers; in others, they are mailed physically on CD-ROMs). The systems communicate with each participant's client software using encoded messages that contain object and positional information to implement on the local system and render to the display.

How dynamic is the environment? This has two aspects: interaction and creation. Little interaction happens when one person moves around a virtual environment and picks up, inspects and possibly uses existing objects (e.g., Myst, QuickTime VR). In a more active system such as a MUD, other participants walk around and do things, too. They may gesture, move, make funny expressions or engage in strange activities. All of the entities -- people, droids, programmable objects and the place itself -- change and interact in response to each other.

2 The VRML discussion is in its early stages. In fact, since VRML doesn't involve any markup per se, the "M" may evolve to "modeling." We will revisit VRML in a future issue of Release 1.0. Meanwhile, you can check out Wired Magazine's Web server (<http://www.wired.com/vrml/>) or join the VRML mailing list by sending the message body "subscribe www-vrml" to <majordomo@wired.com>. The list is quite focused and technical.

The second aspect of the dynamism in these environments is whether the place and the objects within it can be created, changed or destroyed on the fly, and by whom. Usually, the world and its contents are fixed, with the exception of new players who join. Sometimes, as in some MOOs, participants can create their own objects and places. But this capability has yet to emerge in more visual games, probably because the vocabulary and tools are still under development.

In this issue

The companies covered in this issue of Release 1.0 cover the whole range: server and client technologies; bitmaps, pointers and polygons; local and distributed storage; and a variety of features. Most have taken a pragmatic approach. They use standard platforms and ordinary phone connections. They aim for a great user experience on a low-end platform³ but retain compatibility with high-end VR gear.

Apple's QuickTime VR is for static, single-user photo-realistic tours. Immersive Systems' Meme, a network-efficient polygon-based system, is well suited to the creation of distributed, dynamic virtual environments -- the opposite of QuickTime VR. The two could complement each other: Imagine QuickTime VR used as a background, with Meme synthetic objects and avatars in the foreground (the way Roger Rabbit was superimposed on realistic scenes in the Disney movie *Who Framed Roger Rabbit?*).

Knowledge Adventure Worlds (a spinoff from Knowledge Adventure) offers smooth, real-time rendered environments with 3D avatars, but needs server technology such as that from Kesmai or Virtual Universe. Kesmai's Aries is a solid, tested platform for graphical multi-player games such as Air Warrior that can have many tens of concurrent participants. Virtual Universe is adding an important twist: Its Parallel Universe server incorporates a shared audio capability. Independent game developer Virtual Games is creating a MUD-like game atop Virtual Universe's server.

³ The advances we describe clearly benefit from the improved price, performance, penetration and standardization of many technologies, including CD-ROMs, modems, graphics rendering engines and PCs. Compression plays a key role to bridge the gaps (i.e., it makes for satisfying user experiences despite slow modems and CD-ROMs).

MULTI-USER ENGINES

Multi-user virtual environment servers have a tough time. They have to accommodate many participants, give them a satisfying and consistent real-time experience, and make the whole thing computationally tractable and affordable. Here are two that do a good job.

KESMAI'S ARIES PLATFORM

John Taylor, co-founder and president of Kesmai, recently sold the company to Rupert Murdoch's News Corp. Founded in 1981, Kesmai currently has two separate operations, both involved with multi-player games. One part of the company is chartered to develop new games; the other, which we focus on here, is a subsidiary formed to leverage Aries, the Unix-based server technology Kesmai developed to solve the hardware, software and networking issues of multi-player games for large numbers of participants.

Offering a satisfactory real-time game experience to players separated by thousands of miles and connected with 2400- and 9600-baud modems is indeed a challenge. It's especially difficult with a game such as Air Warrior, Kesmai's World War II flight simulator, introduced in 1987.⁴

As aircraft swoop, climb and plunge, client and server software have to communicate, calculate, interpolate and render (client only) the scenery and visible objects. With network latencies that can range from one-half to four seconds, the best calculations and interpolations still result in the occasional jarring repositioning. Yet Air Warrior is realistic and satisfying enough that it attracts active-duty military personnel, who "meet" on online services to "fly" as squadrons at set times each week.

Curse you, Red Baron!

Air Warrior is competitive, so an essential feature is confirmation that an aircraft really was where its attacker thought it was, in order to confirm kills (someday we'll get past the shoot-'em-ups). To do this, the software running on the Aries server constantly matches positional information from its own calculations with those from aircraft on the client machines.

Also, of course, individual players are not beneath tipping the scales in their favor. As Taylor says, "Any game worth winning is worth cheating to win." In order to avoid players' hacking special performance characteristics or new armament configurations for their teams (or guns that always

⁴ We've cited Air Warrior for years as an easily understood example of how client/server computing works. Prospective participants download flight simulator client software, a terrain file and a few other files (they can also get disks from Kesmai). Then they use communications software to log in to the service hosting Air Warrior, exit the comm package without hanging up the phone, and launch the downloaded application. The visual nature of a flight simulator and the flurry of activity generated by many aircraft flying in close quarters, plus the slow speed of conventional modems quickly make clear that the server cannot be drawing all the players' screens and sending them out for display.

hit their target!), the Aries system maintains these parameters at the host. Client machines get them only as needed. This is the kind of security and robust operation that large-scale multi-player games require.

Equal-opportunity service

Kesmai's engineers created Aries two and a half years ago to facilitate the port of Air Warrior to Fujitsu's NiftyServe system in Japan. Now the subsidiary, Kesmai Aries Ltd., is out to maximize Aries' value by continuing to offer it to other online service providers and by consolidating to as few host machines as possible (roughly 60-70 Air Warrior players can run in one arena; seven arenas can run on one server). This means that Delphi's Air Warrior players may well have Genie or Concentric Research players as teammates or opponents.

This makes sense not only from the standpoint of Kesmai's operating efficiency, but as a way to build critical mass. Game developers and service providers require a critical mass of players before they will commit to a new game, as do players. Games are usually more fun when they're near the limit of participants, which can be hard to achieve at odd hours. Delphi, an online service provider also recently acquired by News Corp., offers Kesmai's games and could have insisted on an exclusive arrangement with its new sister company. Instead, however, it is wisely going along with the strategy to maximize use of Aries.

From virtual communities to VR

In an important way, Kesmai has been hosting virtual communities since 1982: Taylor notes that people are there to be together; the game is often an excuse, just like bridge or poker. Kesmai's first game, The Island of Kesmai, was an early role-playing text adventure available on CompuServe. Its other games include Air Warrior, MultiPlayer BattleTech, Stellar Warrior, MUD II, Harpoon Online and Stellar Emperor.

Kesmai experimented with an ISDN-based simultaneous voice and data game in Japan. Taylor believes a voice capability is quite important, and he is investigating various alternatives. Kesmai is also investigating low-cost (sub-\$1000) virtual reality gear, which high-end players might be willing to purchase.

VIRTUAL UNIVERSE

Shared audio capabilities have stumped online game providers for a long time. The packet-switched networks that most of the services rely on for wide-area communications can't carry real-time audio; most modems can't transmit audio and data. ISDN would solve the problem, but it has been slow to emerge. Even if ISDN were ubiquitous, audioconferencing hardware and software isn't appropriate to the task. In fact, audioconferencing is not the right approach at all.

Virtual Universe, a startup based in Calgary, Alberta, has tackled this problem directly and created an elegant solution. In a multi-player online game, each participant doesn't have to hear each other participant's sounds, just those within earshot. To mimic reality, Virtual Universe's

server technology, called the Parallel Universe (Virtual Universe's original name), monitors the "location" of characters and objects, so their sounds fade as the characters move further away.

Proximity and relevance

In general, the Parallel Universe uses participants' positional information, software relevance filters and audio mixers to send each workstation only the information it really needs, and to update the most vital information more often than the rest. More specifically, the Parallel Universe splits incoming voice and data signals. It passes the audio to a processor that calculates relative positions, analyzes who is speaking loudest from each person's point of view, creates custom audio mixes and feeds the resulting streams back to the players. In the process, the server can also balance specific signals between speakers, offering pseudo-stereo that gives an effective illusion of location and movement. As a character walks past you, her voice might shift from the left speaker to the right.

The audio and data streams work together but are processed separately. That makes it possible for you to hear a participant you can't see, for example. The data signal is processed more conventionally, with a small twist for efficiency. The Parallel Universe calculates a field of view from each user's position and orientation, and determines which other participants are visible and their distances. The twist is that the server tags nearer, more important objects with higher refresh rates, so people moving around nearby move more smoothly than those in the background.

Just do it

The company's entrepreneurial spark is James Durward. He is now officially director of marketing and business development. In 1990, Durward had been using the Dialog online database to investigate corporate acquisitions. In the process, he happened across articles on virtual reality, which captivated him. In 1991, he began to think about a system that would allow engineers to conduct remote, interactive design sessions with CAD tools and telepresence. He also began to assemble a team of software engineers to build it. Although the technology worked and was useful, the engineers that were prospective users weren't that enthusiastic about it. At about that time, Alberta Government Telephones conducted a survey that pointed to strong household demand for multi-player games.

Both the technology and the market seemed ready, but the game and network providers were waiting for each other to deliver the necessary technology. Tired of the standoff and aware of an unserved market with a potentially voracious appetite for affordable, networked multi-player games, Durward, president Ian Tweedie (formerly an accountant with Coopers & Lybrand) and their colleagues decided to do it themselves.

Now, 30 months later, Virtual Universe has a prototype 10-user, voice and data battle-tank simulation hosted on a Sparc 2 server. It expects that the system will scale well to support nearly 100 concurrent users on faster processors. Game designers can concatenate Parallel Universe processors to create the illusion of adjacent rooms or environments.

Making it work

When Virtual Universe began development, ISDN wasn't broadly available (and still isn't); the system required two phone lines per participant. Since affordability was an essential design element, Virtual Universe's engineers were delighted to discover AT&T's VoiceSpan voice-and-data modem technology,⁵ which allows their system to work over a single, conventional telephone line.

The caveat is that participants all need to be within local phone calls of their server to avoid incurring long-distance charges. (There's an additional complication: If Virtual Universe or one of its licensees straddled two calling areas and allowed play between them, the fact that it carries audio would make the service provider an interexchange carrier, and subject to regulations and access charges it would rather avoid. Getting beyond local areas is more a political problem than a technical one.)

Thus Tweedie and Durward hope to sell their system to regional phone companies and other entrepreneurs. The system might also make a great complement to a regional bulletin-board system or Internet access provider such as Pipeline or Echo. Tweedie and Durward took the company public in November 1992; now they are looking for partners and further funding. They also need game developers to use their engine. Virtual Games, an independent but co-located company, is building a visual MUD atop the Virtual Universe system (see page 9).

Play as you are

Virtual Universe's system supports varied concurrent communication and display configurations. Some players might use VoiceSpan modems, others ISDN and (if cable operators move that way) some could play via hybrid cable/fiber systems. In any event, Virtual Universe is realistic about the speed with which the infrastructure will evolve, and is prepared to offer satisfying experience with the most likely infrastructure. The Internet offers limited audio capabilities (see the MBONE, Release 1.0, 2-94), but in general its latencies are too high, though it could change. Similarly, most players are likely to use flat CRT displays, but some could be using head-mounted "immersive" VR systems.

5 PF. Magic, AT&T and Sega are using VoiceSpan to develop two-player games that let participants see each other's actions and hear their exclamations over ordinary phone lines (see Release 1.0, 4-94). In principle, this would allow someone to play one game alone, with a partner sitting at the second joystick, over the telephone using VoiceSpan or on an online service such as AT&T's ImagiNation Network. However, practically, players would lose the shared audio capability because of the packet-switched network that INN uses.

THE CLIENT SIDE OF VIRTUAL WORLDS

What makes an interactive experience compelling? It's how the experience hooks into our senses, our emotions or our intellect. It doesn't take much to get the adrenaline or endorphins running, though there's no foolproof formula. The goal of immersive VR systems is to convince the senses with a stereoscopic, textured, lifelike environment that unfolds before users as they turn and move.

Verisimilitude: requirement, distraction or useful tool?

Sometimes we want to read minute details of people's expressions and body language in order to interpret their intent. Software-controlled expressions may make it easier for people to misrepresent themselves, or at least to give miscues. That's where audio can be very helpful. With no visuals at all, the telephone offers an extremely intimate experience and can get you closer even than you would be face-to-face. Audio is immediately realistic; pseudo-stereo makes it a bit better, especially when there's a lot going on.

Perfect realism may not always be better. We may not want our avatars or agents to look and act exactly like us, even with better clothes and fancy accessories. In his book *Understanding Comics*, comics artist Scott McCloud describes how characters that are too realistic can interfere with readers' identification with them. As VR pioneer Jaron Lanier says, "The mind is our strongest ally." As developers explore virtual environments and ways of representing us in them, they may create useful ways to convey meaning -- a new rhetoric for the new medium.

"When you look at a photo or realistic drawing of a
face...you see it as the face of *another*. But when you
enter the world of the *cartoon*...you see yourself."

-- Scott McCloud, *Understanding Comics*

Think of the degree of realism as a variable that can help control the user's experience. In some cases, developers may make the places more realistic than the personae, or vice-versa. They may combine rendered and photographic techniques, text and real-time video or audio. Different participants might see very different renderings and participate in different ways, depending on their equipment and their preferences. The companies described in this section show the variety of possible experiences.

VIRTUAL GAMES' STIM-SLUM

For a long time, Andy Hook has been into games, especially MUDs. Now, with his startup Virtual Games, he's focused on developing multi-player, real-time, 3D games. While playing his favorite games, Hook noticed a qualitative difference between games with few participants and linear plot lines (find the treasure, elude the beast, escape), and those that have more than four or five concurrent players. Large-group games are compelling in a different way. For example, you can't know where all the others are at any given time; people naturally form subteams and create communication webs,

which adds complex dynamics. Also, Hook noticed that these games do very well with minimal plot and very rich environments. In such games, he says, "You can build a rich play world -- a great simulation -- and let the players build their own plot lines."

Armed with his insights and a promising voice-and-data platform from Virtual Universe, Hook is creating an imitation society game called Stim-Slum -- a MUD with graphics, where each player starts out as a bag person with a few currency credits and tries to work up to running the world. Over time, players form teams and buy, get or steal capabilities. They can get and pay back loans. If one team member gets a capability (say, night vision), the whole team can use it. The teams have to hide the objects that represent their special powers; if an object is captured, the capturing team gains its powers and the losing team loses them.

Intriguingly, there is plenty of opportunity for treachery and deceit, as well as loyalty and bravery. Players can be convinced to defect to other teams. If they do, and take with them the cache of special objects, all those capabilities go to the new team. With full audio capabilities and privacy if you can find a secluded virtual place, all sorts of negotiations can go on.

 Derek McLeish, president and ceo of Velocity, the game company that created the popular LAN-based multi-player game Spectre, is interested in the role of events that affect an entire community in an online multimedia environment. He's exploring a "Film at 11" feature in which communities have to deal with broadcast news events such as floods, riots or peace demonstrations.

Hook expects to release the game in early 1995. He also hopes that artists will begin developing affordable virtual worlds for others to enjoy. He has licensed Criterion Software's RenderWare 3D graphics engine.⁶ Participants can't create their own objects, but Stim-Slum offers interesting ones. For instance, players can not only disassemble the weapons they have in Stim-Slum, they can also reconfigure them and change their uses.

APPLE'S QUICKTIME VR: HOP ONBOARD FOR A TOUR

Apple's QuickTime VR offers a photographic, pseudo-3D experience with which a user can tour an actual or synthetic space. It's a great way to visit the Museum of Natural History, for example. Unlike a laser-disk-based video tour, in which the user is limited to the perspectives and pacing of the original video photographer, QuickTime VR responds to the user's navigation commands seamlessly. Users can pan smoothly at will a full 360 degrees, zoom in and out, move about, and inspect some of the objects they

⁶ RenderWare, a popular 3D engine from Criterion Systems in the UK, wins high praise from developers and is in broad use. It does a player's-view rendering of objects, complete with textures, shading and lighting.

encounter. Developers can define "hot spots" in the scenes for users to click on. A hot spot might show users an object, take them through a doorway, play a video or audio clip. QuickTime VR also allows for audio localization, which contributes to the realism of the tour.

Several factors make QuickTime VR better for static environments than one user can tour than for multi-user, highly interactive environments. For one thing, the captured images are photo stills; for another, it's difficult to place objects within the virtual environment, because little positional information is available. This is really a 2D rendering of a 3D world. Where should a developer or end-user set a virtual plate so it sits properly on the table from all viewing angles? Where to place an avatar?

However, QuickTime VR could complement other technologies well. It could act as a mask behind generated worlds or objects, easing the developers' task of creating believable settings. Or a developer could mix rooms that exist with those that don't. Imagine visiting a virtual museum such as the Absolut Museum (page 16), then passing through a door into a representation of a room in a real one, such as the Prado in Madrid. A historian could create an ideal museum that might not be possible at all in real life, and annotate any object with links or text.

Apple's Eric Chen developed QuickTime VR. Eric Zarakov was then in Apple's electronic photography group. Chen had worked alone to create a virtual museum tour, and decided to use real-world images. Zarakov formed a team to commercialize the technology, and is now QuickTime VR's product manager.

How it works

Chen and his team created authoring, navigation and playback tools that assemble ordinary photographs (taken in a special way) into a virtual environment that browsers can traverse. To create a scene, a developer maps a space at regular intervals, with allowances for places that people are not likely to want to browse (such as the spot one foot in from the far corner). Most places have a few natural viewpoints, which saves QuickTime VR developers considerable disk space.

For a detailed area that users will move around in and inspect closely, a developer might place nodes in a two-foot-wide grid pattern. For an outdoor section, it may be fine to set nodes 10 feet apart. Then the developer photographs the 360-degree view from each node with a conventional 35mm camera on a tripod (between eight and 30 exposures per node, depending on the lens). A view from one node compresses to about 1 Mb. Applications that render synthetic environments can save a sequence of views that are compressed similarly.

Once the pictures are developed and digitized, Apple's authoring tools use pattern-matching software to turn the individual images into seamless 360-degree panoramic views. In playback mode, QuickTime VR doesn't interpolate between nodes, which gives slightly jumpy travel as the user shifts from node to node. The authoring process for objects is similar, although different views are stored separately, not merged into one seamless panorama. Objects' files are larger; they range from 3 to 4.5 Mb (in 24-bit color).

Tour the new, improved Starship Enterprise

Apple is licensing QuickTime VR to content developers on the Mac and PC. The first licensee is Simon & Schuster Interactive, which is using QuickTime VR as the technology for its "Star Trek: The Next Generation" technical manual, which offers virtual walkthroughs of the souped-up Enterprise. The company (a division of Paramount, in turn a subsidiary of Viacom) expects to ship the title in September. QuickTime VR requires QuickTime 2.0, which is due by the end of Summer. Apple hasn't set the licensing and deployment strategies yet.

KNOWLEDGE ADVENTURE WORLDS

In 1991, Dave Gobel helped Bill Gross found Knowledge Adventure (KA; see Release 1.0, 2-93). Even before his involvement with KA, Gobel had dreamt of creating highly visual interfaces that would, for example, allow a user to point to a zone on the globe, zoom in, point to specific places, items or people -- while moving through time, of course -- and walk through the Amazonian village, use the local tools or role-play as part of the local tribe. (The "Earth" interface in Neal Stephenson's *Snow Crash* is one way this might work.)

But Knowledge Adventure is dedicated to publishing, and its success led to rapid growth. Gobel's plan was tangential to KA's mission, so he wrote a business plan. This April, KA's board authorized the spinoff and retained a minority equity position.

The resulting company, Knowledge Adventure Worlds, has designed a startlingly compelling, multi-user 3D environment that runs on PCs. The company is now in the process of merging that technology, which leverages KA's state-of-the-art compression technology, with avatars from Kinetic Effects (see box, next page).

A new kind of Yo!

Even with the 2D avatars the current system uses, the experience is remarkable. (In the current demo, the person you interact with looks like a playing card -- the Queen of Hearts.) Developers use KA Worlds' interpreted, English-like scene-description language called Accomplish to build convincing virtual environments in which avatars can move and interact.

The virtual places can be indoors or out; they can have paintings, animations (an aquarium, a fountain and a rotating statue) and doorways to other places. Bricks are brick-like, lighting is convincing and scenes outside of windows mask and zoom appropriately as you approach a window. Users navigate the way they would expect, with a mouse (or keyboard). Click the mouse and a cursor appears; click again on an object and you're brought closer right away, or the object executes, such as a message that opens.

You can identify other participants, hail them and interact by typing messages back and forth. (Your messages show up at the bottom of your screen; your partner's, above his avatar.) This feature is indeed, as Peter Lewis stated in the *New York Times*, "astonishingly cool," even without a Virtual Universe-style audio link.

Staying in character

KA Worlds is incorporating 3D avatars from Kinetic Effects, a company that has commercialized character-animation technology from Simon Fraser University in British Columbia. In their raw incarnation, the avatars, called Life Forms, look like topographical maps of human bodies: They are composed of rings, ovals and slightly more complex shapes stacked atop one another. The human eye fills in what texture-mapping doesn't, and the figures seem solid, especially when they move. Of course, the figures can be rendered fully as well. Life Forms can realistically model walking, running, jumping, dancing, eating and other motions. Watching a half-dozen of them run through routines at the same time on a computer screen is eerie -- and fascinating.

Kinetic Effects developed Life Forms on Silicon Graphics workstations. The company now has the code running in DOS, where users will probably be limited to three or four avatars on-screen at once. With PowerPC-class machines, though, those limits are far less relevant.

Porting the code and integrating the two systems so they'll run on a 386 is the tip of a large iceberg. There are other open issues, many of which will be solved quickly and inelegantly and then improved over time. For example, with a mouse and without taking up the whole screen with knobs, levers and dialog boxes, how do you control an avatar and make its movements expressive? What sort of shorthand can you use to describe actions, mood and speed? It will take some time for software developers to create a way to map a user's intent to avatar behaviors, and make it all available through a simple interface. (Some day we'll call it intuitive, just like driving a car.) But the process will be compelling, and the system will be useful way before all these issues are resolved.

Games and more

While the KA Worlds system can clearly be the platform for an online service, there are other uses, as well. Ogilvy & Mather Interactive Marketing used KA Worlds' engine to create the Absolut Museum, a virtual exhibit of the art that has been created for the Absolut Vodka ad campaigns. Ogilvy & Mather has licensed the technology to develop interactive advertising.

Developers can embed novel communications technology in KA Worlds environments. In fact, KA Worlds developed a prototype for AT&T PersonaLink that includes message notification and retrieval, information services and shopping. According to Gobel, you might be able to place a call by moving through that person's avatar. You would end up in the person's foyer, waiting for a response. Meanwhile, the called party would see your avatar requesting a conversation and could decide what to do.

Movie or television producers could use the KA Worlds system for storyboarding. They could use Accomplish to describe the environment, then animate the action. When production is over, they could put the created world online as a brand extension (which way is Bedrock? Gotham?).

True distributed computing

KA Worlds is a truly virtual corporation: Cole Larson, the chief technical officer (formerly president of Kinetic Effects), is in Seattle; Greg Beasley, the vp of sales and marketing, is in New York City; Dave Marvit, the producer, is in Pasadena; and Gobel, the president, is in Virginia. Most of the staff is in Pasadena. KA Worlds is not only interested in selling virtual offices to others on the Internet, it is building one of its own to house its far-flung staff.

Tech stuff

KA Worlds clearly benefits from the excellent compression, rendering and texture mapping technology of Knowledge Adventure's Zoomscape. It also offers morphing, non-linear movies and other effects. As with other systems, KA Worlds stores objects locally on a CD-ROM in the "body shop." It tokenizes communications and transmits only object IDs, positions and motion.

In order to accommodate large numbers of users, KA Worlds is implementing what Gobel calls a cellular server architecture. Each "place" is a new process, which can run locally or remotely. Say you decide to move your character from the house out to the pool. As you exit the door, you could be passed to a new virtual machine. It could as easily run on the same machine as telnet you transparently to another host. So you could build a virtual house that is partly hosted in New York and partly in California. Users would not know that they had crossed host platforms, unless the designers wanted to make that visible.

The software is still in DOS.⁷ KA Worlds is developing a 32-bit environment in object-oriented, portable C on a Unix platform, from which it will move to Macintosh and later to PowerPC and possibly a set-top or game box. It plans to deliver a Windows version later this year using the graphics enhancements in WinG.

IMMERSIVE SYSTEMS

Most of the systems described so far require a large library of software objects that contains the environment and the stuff that's inside it. Developers must describe, create and distribute the generic objects in advance. Typically, publishers distribute these libraries in the mail on CD-ROMs or users download them from central servers. Individuals may be able to customize some objects (e.g., give their avatars new shoes or hairdos), but the systems' developers are the only ones who can create novel places or objects. MOOs are popular in part because any user can create objects in the system's scripting language. But MOOs are all text.

⁷ Many games have been stuck in DOS because of Windows' poor graphics performance. Microsoft recently delivered WinG, a software library that speeds graphics rendering in Windows; it will be part of Chicago.

Immersive Systems' Meme (Multitasking Extensible Messaging Environment⁹) offers some of that capability for highly distributed, 3D virtual environments. At its core, Meme is an extensible, Forth-like, threaded interpretive language that currently runs only on DOS. Though it started as a programming language, its inventor, Marc de Groot, has since added some OS-level services and a messaging mechanism that allows virtual object to communicate. So Meme is now more of a network-savvy, communicating-objects infrastructure that lets people build, share and destroy virtual environments and objects.

Flexibility and efficiency are Meme's selling points. Meme allows developers to make changes and additions as the environment is running. It bundles data and code efficiently, which allows objects to get through networks quickly. That means a user can quickly receive a description of a new space and view it, as long as she has a Meme interpreter present. Meme is designed for both desktop monitors and immersive virtual reality gear; it uses Criterion Software's RenderWare graphics library.

Marc de Groot, who is mostly self-educated and has been programming since the age of 10, runs Immersive Systems from his home. Some years ago, he ran a TinyMuck (a descendant of MUDs) over ham radio frequencies using packet data techniques over radio. Meme began as a curiosity and turned into a project. Now de Groot has found funding for Meme and is turning it into a real business. A colleague of de Groot's is developing a shape modeler, which will help developers and users build complex objects.

⁹ Meme is no relation to Mime, the Multimedia Internet Message Extensions (see Release 1.0, 2-94).

COMING SOON

- Virtual environments, part II.
- HTML and SGML futures.
- What's a zine?
- Software for education.
- And much more... (If you know of any good examples of the categories listed above, please let us know.)

RESOURCES & PHONE NUMBERS

Eric Zarakov, **Apple**, (408) 974-3158; fax, (408) 974-8414;
 <zarakov@applelink.apple.com>
 Kevin Goldsmith, **Colossal Pictures**, (415) 550-8772 x156; fax,
 (415) 824-0389; <kmg@monk.colossal.com>
 Mike King, **Criterion Software**, +44-483-448800; fax, +44-483-448811;
 <mking@critterion.canon.co.uk>
 Justin Hall-Tipping, **Heartbeat**, (203) 328-3003; fax, (203) 328-3004
 Marc de Groot, **Immersive Systems**, (415) 641-8748; <immersive@kg6kf.ampr.org>
 John Taylor, **Kesmai**, (804) 979-0111; fax, (804) 979-5428; <john@delphi.com>
 Dave Gobel, **Knowledge Adventure Worlds**, (703) 690-2877; fax, (703) 690-7297;
 <daveg@kaworlds.com>
 Cole Larson, **Knowledge Adventure Worlds**, (206) 443-0209; fax,
 (206) 443-9674; <colela@netcom.com>
 Amy Bruckman, **MIT**, (617) 253-5108; fax, (617) 258-6264; <asb@media.mit.edu>
 John Scull, **PF. Magic**, (415) 495-0400; fax, (415) 495-3510;
 <scull11@applelink.apple.com>
 Derek McLeish, **Velocity Software**, (415) 776-8000; fax, (415) 982-3299;
 <velocity@applelink.apple.com>
 Andy Hook, **Virtual Games**, (403) 233-8469; fax, (403) 237-0005;
 <anselm@virtual.cuc.ab.ca>
 James Durward, **Virtual Universe**, (403) 261-5652; fax, (403) 237-0005;
 <jim@virtual.cuc.ab.ca>
 Ian Tweedie, **Virtual Universe**, (403) 261-5652; fax, (403) 237-0005
 John Seely Brown, **Xerox PARC**, (415) 812-4341; fax, (415) 812-4037;
 <jsb.parc@xerox.com>
 Pavel Curtis, **Xerox PARC**, (415) 812-4455; fax, (415) 812-4471;
 <pavel@parc.xerox.com>

For further reading:

William Gibson, **Neuromancer**; New York: Berkeley Publishing Group, 1984.
 Scott McCloud, **Understanding Comics: the Invisible Art**; New York: HarperCollins, 1993.
 Neal Stephenson, **Snow Crash**; New York: Bantam Books, 1992.

Release 1.0 is published monthly, except for a combined July/August issue, by EDventure Holdings, 104 Fifth Ave., New York, NY 10011-6901; (212) 924-8800; fax, (212) 924-0240. It covers PCs, software, computer-telephone integration, groupware, text management, connectivity, messaging, wireless communications, artificial intelligence, intellectual property law and other unpredictable topics. A companion publication, *Rel-EAST*, is an information bulletin on emerging technology markets in Central Europe and the former Soviet units. Editor: Esther Dyson <edyson@eff.org>; publisher: Daphne Kis; managing editor: Jerry Michalski <spiff@panix.com>; circulation & fulfillment manager: Robyn Sturm; editorial & marketing communications consultant: William M. Kutik. Copyright 1994, EDventure Holdings Inc. All rights reserved. No material in this publication may be reproduced without written permission; however, we gladly arrange for reprints or bulk purchases. Subscriptions cost \$495 per year, \$575 overseas.

RELEASE 1.0 CALENDAR

- June 26-July 2 IEEE world congress on computational intelligence - Orlando. Sponsored by IEEE Neural Networks Council. Call Karen Haines, (714) 752-8205; fax, (714) 752-7444.
- July 4-8 ECOOP '94: European conference on object-oriented programming - Bologna, Italy. Sponsor: DEIS, Universita di Bologna. Contact: Paola Mello, 39 (51) 644-3033; fax, 39 (51) 644-3073.
- July 6-8 Artificial Life IV conference - Cambridge, MA. Sponsor: Santa Fe Institute. Call Barbara Hodges, (505) 984-8800; fax, (505) 982-0565.
- July 17-20 Interact '94 - San Francisco. Sponsor: Interactive Services Association. Call Suzanne Nichols, (301) 495-4955; fax, (301) 495-4959.
- July 24-27 CTAM '94 - Chicago. Sponsored by Cable TV Administration and Marketing Society. Call Mary Pittelli, (301) 206-5393.
- July 24-29 Siggraph '94 - Orlando. Sponsored by ACM. Call Anne Leuck, (312) 321-6830.
- July 26-29 Object World - San Francisco. Sponsor: IDG World Expo. Call Bill Hoffman, (508) 879-6700; fax, (508) 872-8237.
- July 31-Aug 4 Artificial Intelligence conference - Seattle. Sponsor: AAAI. Call Annette Eldredge, (415) 328-3123; fax, (415) 321-4457.
- Aug 2-5 MacWorld Expo - Boston. Sponsor: MacWorld Magazine. Call David Eliot, (800) 945-3318; fax, (617) 361-9074.
- August 4-6 First annual conference on the pattern languages of programs - Monticello, IL. Sponsor: University of Illinois, Department of Computer Science. Call Ralph Johnson, (217) 244-0093; fax, (217) 333-3501.
- August 8-12 GroupWare & Workflow '94 - San Jose. Sponsored by The Conference Group. Call David Coleman, (415) 282-9151; fax, (415) 550-8556.
- August 14-17 Software Marketing Perspectives '94 - San Francisco. Sponsor: Software Marketing Journal. Call Stuart Rauch, (415) 989-8765; fax, (415) 295-7766.
- August 17-21 @Online Networking Exposition and BBS Convention (ONE BBScon) - Atlanta. Sponsor: ONE, Inc. Call Peg Coniglio, (303) 693-5253; fax, (303) 693-5518.
- August 23-26 Virtual reality software & technology - Singapore. Sponsor: ACM and the Institute of Systems Science, Singapore. Call Gurminder Singh, (65) 772-3651; fax, (65) 774-4998.
- September 8-10 *ETRE - Barcelona. Euro-Glitterati. Sponsored by Dasar. Call Alex Vieux, (415) 321-5544; fax, (415) 321-5597.
- September 12-14 TransForum '94: An executive forum on business & technology strategies - New York City. Co-sponsored by Forbes ASAP and ITAA. Call Barry Sullivan, (703) 522-5055; fax, (703) 525-2279.
- September 12-16 Informat '94 - Barcelona. The global villages trade show. Sponsored by Dasar. Call Alex Vieux, (415) 321-5544; fax, (415) 321-5597.

- September 14-16 **East-West international conference on multimedia, hypermedia and virtual reality** - Moscow. Sponsor: International Center of Scientific and Technical Information in Moscow. Contact: Peter Brusilovsky, fax 7 (095) 943-0089; e-mail, plb@icsti.msk.su.
- September 18-21 **@Agenda 95** - Scottsdale. Stewart Alsop's party. Sponsor: InfoWorld Editorial Products. Call Therese Solimeno, (415) 312-0545; fax, (415) 312-0547.
- September 20-22 **Networks Expo** - Dallas. Sponsor: Bruno Blenheim. Call Annie Scully, (201) 346-1400; fax, (201) 346-1602.
- September 25-28 ****East-West High-Tech Forum** - Bratislava, Slovakia. The fifth annual sponsored by EDventure Holdings. "Competition or Cooperation: Finding the right mix in a maturing market." Call Daphne Kis, (212) 924-8800; fax, (212) 924-0240; MCI 511-3763.
- September 26-30 **Object Expo Europe** - London. Sponsor: SIGS Publications. Contact: Jane Major, 44 (306) 631-331; fax, 44 (306) 631-696.
- October 2-5 **SPA fall symposium** - Boca Raton. Sponsored by Software Publishers Association. Call Karen Johnson, (202) 452-1600; fax, (202) 223-8756.
- October 4-6 **@UNIX Expo** - New York City. Sponsor: Bruno Blenheim. Call Annie Scully, (201) 346-1400; fax, (201) 346-1602.
- October 5-7 **CD-ROM Expo & Conference** - Boston. Sponsors: Digital Video Magazine, CD-ROM Professional and MacWorld Magazine. Call David Eliot, (800) 945-3318; fax, (617) 361-9074.
- October 5-8 **Software Publishers Association** - Dallas. Sponsor: SPA. Call Nadia Kader, (202) 452-1600, x339; fax, (202) 785-3649.
- October 6-8 ***Euro Channels '94** - Paris. For distributors and vendors. Sponsor: Global Touch. Call Denise Sangster, (510) 601-7573; fax, (510) 601-5639.
- October 10-12 **Technology Seminar** - Baltimore. Sponsor: Alex. Brown & Sons. Call Kimberly Lynne, (410) 783-3240; fax, (410) 783-3058.
- October 11-13 **Intelligent multimedia information retrieval systems & management** - New York City. Sponsors: Centre De Hautes Etudes Internationales D'Informatique Documentaire France and Center for Advanced Study of Information Systems USA. Contact: J.M. Brentano, 33 (1) 42 85 04 75; fax, 33 (1) 48 78 49 61; in US Peter Brodnitz, phone/fax (212) 741-1421.
- October 17-19 **Microprocessor Forum** - Burlingame, CA. Sponsor: Microprocessor Report. Call Leslie Hunziker, (707) 823-4004; fax, (707) 823-0504.
- October 19-21 **PC Expo** - Chicago. Sponsored by Bruno Blenheim. Call Annie Scully, (201) 346-1400; fax, (201) 346-1602.
- October 22-26 **@CSCW '94** - Chapel Hill, NC. Sponsor: ACM. Call Kevin Jeffay, (919) 962-1938; fax, (919) 962-1799.
- October 23-27 **OOPSLA '94** - Portland. Sponsor: ACM. Call Steve Poltrack, (206) 865-3270.
- October 24-28 **INTEROP 94** - Paris. The mother of all networking conferences. Sponsor: Interop Europe. Contact: Carinne Propper, 33 (1) 4639-5656; fax, 33 (1) 4639-5699.
- November 6-11 **Electronic document systems conference & exhibit** - Phoenix. Sponsored by Xplor International. Call Anne Davison, (310) 373-3633; fax, (310) 375-4240.
- November 14-18 ***@Comdex** - Las Vegas. The biggest US show of all. Sponsored by the Interface Group. Call Peter Young, (617) 449-6600; fax, (617) 449-6953.

December 5-7 IT Services '94 - Santa Clara. Sponsor: Creative Expos and Conferences. Call Cherif Moujabber, (508) 660-7099; fax, (508) 668-2416.

December 6-9 Internet World '94 - Washington, DC. Sponsor: Mecklermedia. Call Milissa Brigante, (203) 226-6967; fax, (203) 454-5840.

1995

February 5-8 *Demo 95 - Palm Springs. Stewart's picks. Sponsored by Info-World Editorial Products. Call Therese Solimeno, (415) 312-0545; fax, (415) 312-0547.

February 14-16 Networks Expo - Boston. Sponsored by Bruno Blenheim. Call Annie Scully, (201) 346-1400; fax, (201) 346-1602.

February 20-23 Digital Hollywood - Beverly Hills. Sponsored by American Expositions. Call (212) 226-4141.

March 5-8 **PC Forum - Phoenix. Sponsored by us: You read the newsletter; now meet the players. Call Daphne Kis, (212) 924-8800; fax, (212) 924-0240; MCI 511-3763.

March 7-9 Documation '95 - Long Beach, CA. Co-sponsored by PTM, GCA, The Gilbane Report and GCARI. Call Frank Gilbane, (617) 576-5700; fax, (617) 576-5708, or Marion Elledge, (703) 519-8160; fax, (703) 548-2867.

May 7-11 CHI '95: Mosaic of Creativity - Denver. Sponsored by ACM. Call Rosemary Wick Stevens, (415) 328-3600.

May 8-11 EMA '95 - New Orleans. Sponsored by Electronic Messaging Association. Call Heather Burneson, (703) 524-5550; fax, (703) 524-5558.

* Events Esther plans to attend.

@ Events Jerry plans to attend.

Lack of a symbol is no indication of lack of merit.

Please let us know about other events we should include.

RELEASE 1.0

SUBSCRIPTION FORM

Please enter my subscription to **Release 1.0** at the rate of \$495 per year in the U.S. and Canada. Overseas subscriptions are \$575, airmail postage included. Payment must be enclosed. Multiple-copy rates available on request. Satisfaction guaranteed or your money back.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____

☐ Check enclosed.

☐ Charge my

☐ American Express ☐ MasterCard ☐ Visa

Card Number _____ Expiration Date _____

Name on Card _____ Signature _____

☐ Please send me information on your multiple-copy rate.

Please fill in the information above and send to:

EDVENTURE HOLDINGS INC.
104 FIFTH AVENUE, 20TH FLOOR
NEW YORK, NY 10011

If you have any questions, please call us at 1 (212) 924-8800;
Fax 1 (212) 924-0240; e-mail MCI:511-3705;
Internet 0005113705@mcimail.com.

Daphne Kis
Publisher